



# A Survey on forensic odontologists' activity in Italy during the COVID-19 pandemic



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## ABSTRACT

Few information on virus contagion at the beginning of the covid-19 pandemic led to severe restrictions in the dental and forensic activity in Italy, the introduction of procedural guidelines and implementation of preventive measures. A specific survey on Italian forensic odontologists (FODs) activity was conducted to investigate the COVID-19 pandemic impact on daily practices, the preventive measures adopted to manage the risks of contagion procedures performed on living and dead people and the possible peculiar cases that required the intervention of a medical examiner. A total of 122 FODs answered, mostly males over 46 years coming from northern Italy. The results highlight the lack of specific guidelines for the procedures on living people compared to those on the dead but the regulations for the daily clinical practice resulted more than sufficient: in fact, more than 80% of FODs adopted the preventive and safety measures provided for dental practices. The forensic activity significantly decreased during the initial period (more than 75%) and gradually normalized to pre-pandemic numbers in approximately 50% of cases after the implementation of the vaccination campaign. 13 cases of occupational contagion have been reported, most of them (more than 85%) in northern and central Italy. In two cases members of the dental staff sued the employer for responsibility in the contagion. The decrease of the overall ID activity during the pandemic time can be more likely attributed to the of the dental data than the real impact of the pandemic regulations. The use of telematic tools, such as teleconferences, for many procedures proved to be an important resource useful for application even in post-pandemic times.

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## 1. Introduction

The restrictions induced by the Covid pandemic have caused to people all over the world many kinds of huge disruptions to daily life and working behaviors. This resulted especially true for the dental professionals for the high risk of infection and virus dissemination implied in the typical close, continuous and prolonged contact dental operations with aerosol production.

In the beginning of the pandemic, when nobody still knew much about the virus diffusion, the dental offices and clinics were let open to public for urgencies and operations which couldn't be postponed, according to the recommendations of the Italian Medical and Dental National Board (FNOMCeO). After the first lockdown, though, more

precise operational guidelines were released by the Italian Ministry of Health [1] and also by some dental scientific societies [2,3] then furtherly updated according to the continuous flow of evidences about the virus behavior and characteristics.

Triage procedures, use of proper PPE (personal protective equipment) for dental staffs, preliminary mouth rinsing of patients, and detailed measures for disinfection and ventilation of the different areas (operative, reception, etc) of the dental offices were quickly implemented and became compulsory for public and private dental clinics and professionals. Non specific guidelines or procedures were released for forensic odontology or medico-legal activity with the exception of some recommendations for autopsies provided by the pathologists [4–9], that resulted useful for forensic odontologists dealing with dead bodies. According to the Italian judiciary system, however, some medico-legal activities requested by the magistrates' Courts, and related to civil litigation and about permanent impairment evaluation, raised several issues during the

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pandemic period. The procedure usually requires that the expert go to Courts to be officially charged of the case in presence of the magistrate and lawyers; then the visit of the claimant is performed in a session open to other parties, lawyers and experts. A thorough medicolegal visit of the stomatognathic system requires some time and is performed directly on the patient without facial mask. These operative circumstances implied specific risks of contagion, that required to be properly managed by the forensic odontologists involved during COVID-19 pandemic.

A recent research conducted via questionnaire administered to 34 different countries found that the activity of a forensic dentist is limited to body or bite mark identification and age estimation only in 27% of the countries [10]. According to the aforementioned research, the activity of a forensic odontologist is extended in Italy to include dental malpractice analysis, evaluation of oral impairment for Courts, private parties and insurance companies. [10].

The odontologist's forensic activity was accordingly disrupted by the large virus diffusion, considering especially the characteristic of no urgency of most of his practice. Even the magistrates' activity was mainly suspended for some months (March–April 2020) firstly and then simply reduced for some others (till July 2020), with limited possibilities of public access to the courts and parallel development of online procedures with the sole exception, obviously, for any undeferrable civil proceedings or criminal courts' activity.

Moreover, a unique telematic transmission of all the judicial acts and documents has been established only for civil proceedings since 2014 whilst for criminal investigations and trials only paper files were used.

In this weird period of time, any forensic odontologist appointed by private clients or by the Court carried out the visits applying the same rules and preventive regulations adopted during the usual dental clinical activity. Just the civil judicial procedures involving the odontologist, usually performed in presence, were made completely online and via the nowadays famous many video conferencing platforms.

In special cases, especially when a medico-legal assessment was requested to the forensic odontologist by an insurance company, technical reports were written “*per tabulas*”, term which means “on the examination of the documental evidences” and without the direct clinical examination of the individual involved.

To the authors' knowledge, no previous studies investigating the direct, (i.e. caused by the contagion) and the indirect (caused by the prophylactic regulations and restrictions) impact of the pandemic on the forensic odontological activity are available. The procedure of ascertainment of body lesions and impairments is commonly and globally based on the direct examination of the dead bodies with an autopsy and on the direct assessment on living subjects [10–12].

A specifically designed survey was addressed to investigate how extensively the COVID-19 pandemic impacted directly and indirectly on the Italian forensic odontologists' daily activities, the procedures adopted to manage the different contagion risks for expertise conducted on living people or dead bodies and the possible peculiar cases which required the intervention of a forensic practitioner.

## 2. Materials and methods

Given the lack of similar studies, a specific questionnaire was developed according to the structure of some previous questionnaires used to investigate the impact of Covid-19 pandemic on the daily clinical dentistry activity [13–18].

Our questionnaire consisted of 30 questions, 28 of which were close-ended and multiple choice and 2 were open-ended (specialty and region/ city of activity; [Supplementary Material](#)). The subjects covered by the questions have been divided into sections and summarized in the attached supplementary document. The first section investigated any general difficulty encountered by the

professional; the second set of questions aimed at investigating the forensic odontologists' activity as expert for Courts, insurance companies or private parties during the pandemic different periods of time. The third section focused on the management of the cases of body or bite mark identification or age estimation while the last questions investigate the possibility of any future development in the professionals' daily practice. Most of the questions referred to three different pandemic time intervals: the first lockdown (from 08.03.2020 to 04.05.2020), the period of time immediately after the lockdown (from 06.05.2020 to 06.11.2020); the third period of time, after 06.11.2020. The virus diffusion, contagion risks, legal restrictions and regulations changed significantly in Italy during these three time intervals, hence we assumed that the impact should have been investigated accordingly.

The forensic odontological community in Italy is uneven and the lack of statistical or epidemiological data do not allow to know exactly the inference of this type of activity in Italy. Many FODs, even if adequately trained, carry out forensic activities with discontinuity. Thus, selection of the sample for the online survey was made by invitation to all the members of the Italian largest forensic odontology association (Pro.O.F- Forensic Odontology Project).

The participants had access in absolute anonymity to the questionnaire that was available from 18.06.2021 to 20.09.2021, then the collected data were elaborated with descriptive statistic.

## 3. Results

As the main result, a total of 122 professionals answered to our request. The sample has been divided by age (five age cohorts with a 26 over 66 age range), gender and region of provenance (northern, central, southern Italy). Respondents were 74% male and 26% female, largely aged over 46 years. More specifically, answering FODs' (forensic odontologists) age was as follows: 26–36, 9% (n. 11); 37–46, 15% (n. 18); 47–56, 31% (n. 38); 57–66, 37% (n. 45).

The participant FODs came from 16 regions of, the national territory: 90% from the northern and central regions (51% and 39% respectively) and only 10% from the southern part of Italy. The northern regions included: Lombardia, Liguria, Piemonte, Emilia-Romagna, Veneto, and Friuli-Venezia Giulia; the central regions included: Lazio, Toscana, Umbria, Marche, and Abruzzo; the southern regions included: Calabria, Sicilia, Puglia, Molise, and Campania.

53 odontologists stated that they are usually enrolled by Courts and Private Parties. The mainly represented activities are expertise for civil or criminal Courts (about 50% of the whole) and impairment evaluation and dental malpractice cases for private parties (about 35%) in all the three regional areas ([Fig. 1](#)). The procedures performed for insurance companies was the least represented in all the regions.

The number of the assignments decreased significantly regardless of the geographical area for 79% of the answering FODs during the first lockdown – from 08.03.2020 to 04.05.2020 ([Table 1](#)).

The reopening of most activities and businesses after the lockdown (second pandemic phase from 06.05.2020 to 06.11.2020) was followed by a maintenance of the number of the assignments for the 42.5% of the FODs and an increasing one in the 23.8% of the sample. The increasing of the assignments interested mainly FODs located in the northern (41%) and central regions of Italy (45%), while, in contrast, those from the southern regions recorded a decreasing of the assigned tasks (66.6%) ([Table 1](#)). This trend is actually confirmed and equally distributed over different national areas. Most FODs reported to have now the same number of tasks compared to pre-pandemic time (54%), whilst an increased charges occurred in 12% and a decrease in 34% of the interviewed practitioners.

In [Table 2](#) are reported the special precautions adopted by the FODs who were required to perform a special visit of a patient for any kind

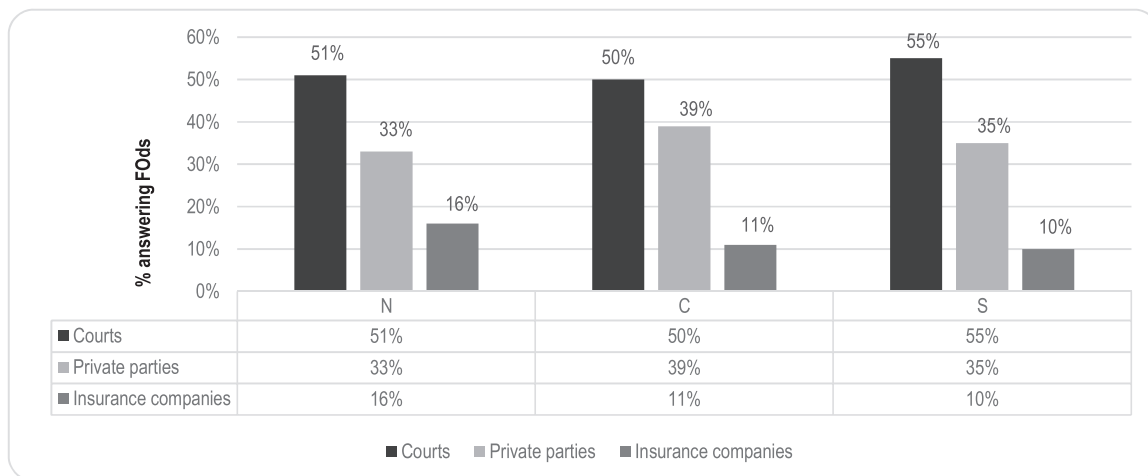


Fig. 1. Activities distribution for different parts of Italy. Pre-pandemic data.

of assignments (criminal or civil Courts, Public Prosecutor, police, private parties, insurance companies, etc).

The reduction of the number of the participants is mainly related to dental visits requested by a magistrate Court, to which parties, lawyers and experts of the parties must normally be admitted. Given the high risks of contagion, the FODs who acted as experts for the Court were allowed by the Judge to ask for a reduction of the number of the participants or even to perform the visit behind closed doors, being anyway granted to the lawyers or the other experts the remote online participation to the procedure through one of the many platforms for teleconference.

The evaluation method "per tabulas" (expertise without direct visit and only based on the documents) was adopted by 23% of the sample and only for cases provided by the insurance companies. The guidelines available for dental clinical practice were deemed adequate for the odontologist activity for the 90% (110) of respondents, and the 53% considered that the preventive measures, especially the use of PPE, were more necessary for the usual clinical dental practice rather than the forensic one. (Table 2).

Troubles in daily practice due to the pandemic and related precautions was experienced by the 57% of the respondents and were evenly reported independent of age or area of origin, apart from a consistent higher occurrence reported by FODs aged > 66 years (90%) (Table 3).

The reported difficulties were: travel limitations (66%), partial closure and restrictions on admissions to offices and courts (52%), and the evaluation "per tabulas" and via telemedicine (23%) for those who have carried out activities for insurance companies. In 19 cases (15%) a complain have been issued for the misuse of PPE by the experts appointed by the Courts during the expertise meetings with

the parties and/or for having prevented the remote participation of the experts to those meetings. Only in one but significant case, one expert was prevented from participating in presence to the medical examination and the interruption of any relationships with the parties followed; all the complainants were male and over 47.

The 80% of the affected professionals continued to carry out their activity from home (the so called "smart working"); the 20% completely stopped their activities regardless different age cohorts and regions.

Online procedures for Court trials and the related expertise and tele-visiting got the support of the 85% of the FODs during the pandemic. Moreover the 34% of the participants considered the online remote procedures (online Court audiences, tele-visiting, telematic submission of experts' reports, etc) an useful alternative to the activity in presence also in the coming post-COVID era.

The Table 4 shows the confirmed COVID-19 cases of occupational origin among the members of the dental staff, all from individuals coming from northern or central regions (panel A). No participants from a southern region contracted the disease; all certain contagions, either professional or extraprofessional, occurred in northern region (panel A).

13 contagions have been reported as occupational accidents, more than 50% (7 cases) of which by dental assistants, 5 by dentists and only 1 by a dental hygienist. In two cases the employee filed a civil claim for contagion caused by a negligence of the employer. Both cases were reported in Como, a city in the northernmost part of Italy. No criminal lawsuits for occupational contagion were reported by the respondents to the survey (panel C).

Looking at the "core" of the odontologists' forensic activity - as such, human identification (ID), bitemark analysis and age

Table 1  
FODs' assignments during the different phases of the pandemic compared to pre-pandemic period.

Pandemic phase	Regions/ answering	Trend		
		Fewer	More	Equal
First lock down (from 08.03.2020 to 04.05.2020)	North/ (62)	77% (n. 48)	2% (n. 1)	21% (n. 13)
	Central/ (48)	83% (n. 40)	4% (n. 2)	13% (n. 6)
	South/ (12)	75% (n. 9)	/	25% (n. 3)
	All areas/ (122)	<b>79%</b> (n. 97)	<b>2,5%</b> (n. 3)	<b>18,5%</b> (n. 22)
From 05.05.2020 to 06.11.2020	North/ (62)	26% (n. 16)	32% (n. 20)	42% (n. 26)
	Central/ (48)	39% (n. 19)	17% (n. 8)	44% (n. 21)
	South/ (12)	66,6% (n. 8)	8,4% (n. 1)	25% (n. 3)
	All areas/ (122)	<b>34,5%</b> (n. 43)	<b>23%</b> (n. 29)	<b>42,5%</b> (n. 50)
After 06.11.2020	North/ (62)	34% (n. 21)	16% (n. 10)	50% (n. 31)
	Central/ (48)	36% (n. 17)	6% (n. 3)	58% (n. 28)
	South/ (12)	25% (n. 3)	16,6% (n. 2)	58,4% (n. 7)
	All areas/ (122)	<b>34%</b> (n. 41)	<b>12%</b> (n. 15)	<b>54%</b> (n. 66)

**Table 2**  
Precautions adopted by FODs during pandemic period for visit of livings.

Precautions*							
Tot.	PPE	Triage	Fewer participants to visit	Televisiting	Expertise on documents (no visit)	Visit postponement of fragile people	Visit postponement of people in quarantine
100% (n. 122)	83% (n. 101)	62% (n. 76)	69% (n. 84)	56% (n. 69)	23% (n. 28)	21% (n. 26)	38% (n. 45)
<b>More precautions for dental clinical activity*</b>							
No 47% (n. 57)	PPE		Room ventilation		Triage for COVID-19		
Yes 53% (n. 65)	/ 46% (n. 56)		/ 34% (n. 42)		/ 34% (n. 42)		

\*More than 1 answer was allowed.

estimation - it results that only 4 odontologists out of 122 respondents were involved in such cases since March 2020. They reported 2 cases of age estimation, 4 cases of human ID, and 1 case of bitemark analysis. Moreover, 10 FODs were involved in 8 cases of domestic abuse, 3 cases of abuse on a disabled individual, and 1 case of child abuse (Table 5).

#### 4. Discussion

Since the first weeks of 2020 we have been living a difficult period of time in which a new Coronavirus, diffused all over the world as a pandemic, caused severe consequences, grave social inequalities and health services disruptions even influencing the socio-economical stability of the countries. Healthcare workers were in the first line to tackle the pandemic issues and forced to suffer from staff crisis, ethical dilemmas, overwhelming exhaustion, paying in term of severe consequences for their life and mental and physical illness.

The researches in the Literature, many of which based on forms sent to a specific category of health workers, investigate the difficulties in performing their activity related to the virus diffusion; among them there are also five studies about dentistry in Italy during the time of pandemic.

Cagetti e coll. [13] sent a form to 3599 dentists from northern Italy since that part of the country was, almost in the beginning of the pandemic diffusion, the most affected region. The Authors investigated mainly the development of the Covid infection and the positive and symptomatic cases among dental workers, finding that 473 participants (13.1%) suffered from one or more symptoms referable to Covid-19 syndrome but only 31 (0.86%) individuals resulted positive to Covid and only 16 of them really developed the disease.

Consolo et al. [14] investigated the psychological consequences of the pandemic and the adoption of preventive measures in a population of dentists from the Modena and Reggio Emilia area in northern Italy. This study confirmed that the Italian dentists fully adopted the national and international guidelines and shut down their practice or strongly reduced their activity. The 74,4% of the

participants told that Covid-19 has had a very negative impact on their activity and the most part of them (89,6%) was very worried also for the future of their professional activity.

De Stefani et al. [15] sent a form to 1500 Italian dentists in May 2020 to investigate their attitudes toward the Covid-related risks; Sinjari et al. [16] and Izzetti et al. [17] confirmed that dental operations were strongly reduced during the first lockdown and limited to the emergencies.

The research of Johnson et al. [19], based on forms sent to Indian forensic odontologists, found that it is necessary to implement protocols for the virus infection prevention but also to provide the healthcare workers with the necessary safety conditions to cope with emergencies.

Because of the lack of previous similar studies in the forensic fields, our research and the data collected from the forms represents a new perspective in the investigation of the impact of the pandemic on forensic activity and give us a full and clear picture of this period of time and its consequences on the Italian forensic odontologists' activity performed on living and dead bodies.

Most of the participants in our sample are men, in line with the data from the CED FNOMCeO (Data Elaboration Centre of the Italian Medical and Dental National Board) which in 2019 counted 22,899 male professionals out of a total of 35,536 registered dentists. Similarly, the most represented age range is from 47 to 66 years, the same average age reported by the 2019 FNOMCeO data. Speaking about the forensic activity, this can be possibly explained with the long training necessary to acquire enough skill and knowledge to satisfactorily practice such a profession. The answering FODs come mostly from northern Italy, and especially from Lombardia, one of the worst hit regions by the pandemic. The geographical distribution of the results corresponds exactly to the distribution of the general population (about 18 mil North; 12 mil Centre; 14 mil south) and the higher percentage of dentists and Fods in the Italian northern regions. Moreover, the impact of COVID-19 was pretty higher in the northern regions of the country at least during the first pandemic wave.

The forensic professionals, as those of all the other specialties did, denounced difficulties in performing their activity with a sharp

**Table 3**  
Difficulties caused by the pandemic during the different phases.

Difficulties caused by the pandemic*									
	Age/Answering					Regions/Answering			Tot.
	26-36 / (n. 11)	37-46 / (n. 18)	47-56 / (n. 38)	57-66 / (n. 45)	> 66 / (n. 10)	North / (n. 62)	Central / (n. 48)	South / (n. 12)	n. 122
Yes	45.5% (n. 5)	39% (n. 7)	60% (n. 23)	55.5% (n. 25)	90% (n. 9)	63% (n. 39)	44% (n. 21)	75% (n. 9)	57% (n. 69)
No	45.5% (n. 5)	39% (n. 7)	32% (n. 12)	42.5% (n. 19)	10% (n. 1)	30.5% (n. 19)	46% (n. 22)	25% (n. 3)	36% (n. 44)
No answer	9% (n. 1)	22% (n. 4)	8% (n. 3)	2% (n. 1)	0	6.5% (n. 4)	10% (n. 5)	0	7% (n. 9)

\*answer options: travel limitations - partial closure and restrictions on admissions to offices and courts - evaluation "per tabulas" and via telematic tools - use of PPEs - ensuring the safety distance - general state of difficulty both with colleagues and with patients. Each answering Fod could mark more than one option.

**Table 4**

Contagion of dental staff member. Occurrence (panel A); reports to worker protection insurance (panel B); civil and criminal claims against employer (panel C).

A. Cause of contagion	Extraprofessional	Professional	Not known	Total
Total Contagion n. / %	8 cases / 50%	3 cases / 18,75%	5 cases / 31,25%	16 / 100%
Region n. / %	North 100%	North 100%	North 3/60% Central 2/40%	14 / 87,5% 2 / 12,5%
<b>B. Reported occupational accidents</b>	<b>Dental Assistants</b>	<b>Dental Hygienist</b>	<b>Dentists</b>	
Total Contagion n. / %	7 cases / 53,8%	1 case / 7,7%	5 cases / 38,5%	13 / 100%
Region n. / %	North 4/57% Central 2/28.5% South 1/14.5%	North 100%	North 2/40% Central 2/40% South 1/20%	7 / 53,8% 4 / 30,8% 2 / 15,4%
<b>C. Dentists sued by employees for occupational contagion</b>	<b>North (%)</b>	<b>Central (%)</b>	<b>South (%)</b>	
Civil claims	2 (100%)	0	0	2 / 100%
Criminal claims	0	0	0	

**Table 5**

Violent crimes and cases of age, body and bitemark cases.

	Case n/ %	FODs enrolled n/ % overall respondents
Age estimation	2	2/ 1,6%
Dead body ID	1	4/ 3,2%
Bitemark analysis	1	1,2%
Domestic violence	8	8/ 6,5%
Disabled people abuse	3	3/ 2,4%
Child abuse	1	1/ 1,2%

decrease of the assignments in all the geographic areas since the beginning of 2020, when the virus first diffused all over the country, the knowledge of its characteristics was very poor, and the first tentative procedures to manage the sanitary emergencies were implemented. As expected, the forensic activity in general, in Court and private practice, along with the clinical one, was suspended with the only exception of the emergencies and the proceedings in Court which could not be postponed.

Furthermore, our research analyze the trend of the assignments in three different phases of the pandemic. In the period May–November 2020, since many businesses reopened, a new spike in the number of infections and new and stricter regulations from the government caused a general plateau in the odontological activity in northern and central Italy and a further decrease in the southern. Only in few cases it was registered a slight increase of assignments in northern and central Italy in this period. In the following phase, after November, many new regulations and regional restrictions were introduced according to the virus diffusion and hospital occupancies, and the trend of the FODs activity remained the same. Many more difficulties, which may explain the trend, affected this phase: quarantines, travelling restrictions, limits of access to Courts and public offices, evaluation "per tabulas" or tele-medicine visits. Among the difficulties reported, there were also problems in the triage procedures, reduction, re-programming or postponement of the visits, problems in the use of the PPE (especially the FFP2/KN95 masks) [19–21] and in keeping the social distancing rules properly which in some cases caused complains to the FOD appointed by the Court.

The precautional procedures implemented by the FODs were the same as in the clinical activity, even if a 53% of the participants reported a more focused attention to the rules during the forensic activity especially for the proper adoption of the PPE, room ventilation and triage procedures. This is quite obvious since the proposed guidelines for general dentistry are considered adequate and useful and the procedures in the daily clinical practice produce much more aerosol with the use of ultrasonic instruments and turbines and surgery [22,23].

The personnel in the autoptic room, at risk for the possible contact with infected material from the corpses, sharp injuries, splashes, and aerosol diffusion, had been properly instructed about the possible presence of the SARS–CV 2 in dead bodies up to (at least) 16 days at high viral loads and also in an active replication status

which could transmit the infection by dermal inoculation, inhalation, ingestion, contamination of intact skin or oral, nasal, eye mucous membranes [24]. Then, the risk of contagion could be considered of relatively scarce relevance when some supplementary precautions are carefully applied to the standard universal precautions for infection prevention and an adequate compliance with safety protocols is ensured [5–9].

This is clearly showed by the low percentage of occupational contagion recorded by the questionnaire responding FODs which is around 2,4% (3 out of 122, Table 4 panel A) compared to the highest percentage of the total contagions (extra-professional and unknown, Table 4 panel A) registered among the participant (dentists and dental staff) which was about 13,1% (16 cases). These data are in agreement with the Discepoli et al. survey [18], which reports a percentage of 4.7% positive diagnosis to COVID-19 among dental staff (dentists and dental hygienists) with a double of positive participants in Northwest regions than the other geographic Italian area.

However, the questionnaire shows higher amount of reported occupational accidents due to professional contagion, mostly by dental office assistants (13 referred cases, Table 4 panel B). Generally speaking, the reported accidents decreased in 2021, thanks to the general lockdown and the suspension of numerous activities. Of that number, however, nearly 7 out of 10 cases affect health workers. In the pandemic year, road accidents denounced to the insurance companies consistently decreased, while, on the contrary, the occupational recorded a 7,9% increase compared to 2019 only in the industry and services sector. Such an increase, from approximately 28,500 cases in 2019 to over 96000 in 2020 (+ 236.5%), is driven almost exclusively by the cases found in the work sector mostly exposed to the high risk of contagion and significant stress such as healthcare and social assistance [25]. It must be specified, however, that a specific category of workers, similarly especially exposed to the risk of contagion, such as family and self-employed doctors and dentists, are excluded from the protection of the national occupational insurance offered by INAIL and therefore also from the aforementioned data. The National Institute for Insurance against Occupational Accidents (INAIL) is an Italian non-economic public body that manages compulsory insurance against occupational accidents and diseases and which applies an accurate evaluation of the possible source of contagion as the first stage of the forensic investigation in cases of Covid-19 positivity.

In two cases, the personnel sued the dentist or the dental clinic, for responsibility in the occupational contagion. These two cases do not apply to the INAIL protection of the exposed worker, but they are normal civil lawsuits brought to obtain compensation (Table 4 panel C).

They are few actually, but the outcome of the cases may prove to be worrying for the dentists if the infected worker gets a favorable sentence. We have no information so far about the evolution of these civil trials and this is a limitation of our research.

In addition, most of the declared occupational infections (Table 4) where reported in northern Italy: 100% of the cases of



infections in the occupational context that led to the interruption or re-programming of the visits, 57% of the dental assistant infections and 100% of the hygienists. This figure is not surprising considering that the northern regions, and especially Lombardia, were among the most affected by the number of cases and diffusion of the infection in Italy.

In the Literature we found other unpleasant and disappointing data: during the pandemic some authors reported a significant increase in the number of violent crimes, such as domestic abuse and harassment. The number of domestic abuses against women registered a worrying peak in the last 18 months, and as such the UN defined the phenomenon as a real “shadow pandemic” [26].

This phenomenon has been investigated also in our research but, since the limited data in our study, it is difficult to take definitive conclusions on the matter. We may anyway confirm that among the participants in our research we found 12 cases of assignments by the Courts regarding violent crime cases and in particular 8 cases of domestic violence, 3 cases of abuse of disable, and a single case of child abuse (Table 5).

Conversely, the low rate of assignments for dental age estimation and body identification should be regarded as only partially due to pandemic impact. Especially for the common body identifications, dental data are largely overlooked as primary identifier in Italy so the Italian odontologists are not regularly involved in such activities independently from the pandemic outbreak [10]. This statement was confirmed by the answers in our questionnaire showing that the FODs were usually involved mainly in civil litigation cases (Fig. 1). On the contrary, the number of age estimations procedures requested for children was lower than the expectations. Age estimation assignments probably fell down because they were largely postponed by Juvenile Courts for the risk of contagion and for the strong engagement of the local health authorities against the pandemic diffusion. However, it should be considered that the adoption of a standard multidisciplinary protocol, especially in cases of unaccompanied minors, is still lacking in Italy. There is still no real agreement in Italy on the methods to apply for age estimation and on the involvement of the odontologist in the procedure. Thus we expected to find a limited involvement of the forensic odontologists and the real impact of the pandemic in such activities is quite difficult to find out.

The forensic odontology professional environment looked with a bit of scepticism, at first, followed however by an increasing favour, at the introduction of online procedures such as videocalls, video conferences, use of certified e-mail services, which so often helped in, or even substituted, the usual procedures during the pandemic time. Many insurance companies are nowadays facing an increase in the administrative costs of the claims. A future goal seems to be the implementation of an end-to-end digital procedure for the whole management of the claim (from its opening to the eventual compensation), practice which has been already significantly and successfully adopted in the pandemic time even in the assessment procedures of medical and dental malpractice cases. The development of a fully telematic procedure would certainly increase the efficiency of the case management eventually leading to a cost reduction for all the parties involved. However, some relevant limitations suggest that the online procedures, even if useful tools to support the traditional forensic activity, won't be able to fully replace it almost in a near future. Such limitations can be considered the ever more strict attention to the proper acquisition, management, and protection of personal data [27] and the limited reliability of a visit made with digital tools in the identification of signs or symptoms in some cases. (e.g. mild skin lesions, symptoms detectable by palpation or percussion) [28,29].

Digital tools and procedures, though, can be profitably adopted also in identification procedures and dental autopsies and can still be considered as a valid option when an odontologist cannot be present

on site after a mass disaster or a on a place where a single unidentified body has been found. However, it should be noted that, albeit digital delivery of healthcare is promising and widely used, it entails significant medico-legal issues. For instance, telemedicine is burdened by the legal issue of de-coupling (the practitioner and the patient can be in places with different medical malpractice laws) and with the risk of data breach due to the so-called “digital footprints” [27].

## 5. Conclusion

The COVID-19 pandemic strongly disrupted any health and forensic activity. The Italian forensic odontologist faced risks of contagion in the usual activity either with the living individuals, or criminal and civil procedures, post mortem assessments in ID procedures. The forensic odontologists in their PM autopsy activities relied on guidances issued by some scientific societies and from papers published by pathologists, while their activity on the living has been much less guided because of the variability of the daily practice, taking all the risks of it in the pandemic time.

Our research has been based on the answers to a survey from 122 Italian forensic odontologists. The following main results emerge:

More than the 80% of the participants adopted preventive and safety measures (FFP2 masks, triage, room ventilation) even if half of them believed that the usual clinical procedures are more risky for the inherent aerosol generated.

As could be expected, during the initial lockdown time, about the 75% of the FODs assisted to a sharp decrease of the assignments, which increased after the implementation of the vaccination campaign (to the pre-pandemic numbers in the 50% of the cases).

The participants to the research reported 13 cases (54% chair assistants; 38% dentists) of occupational contagion complained to the National Institute for occupational insurance (INAIL). More than the 85% of these cases were instructed in northern and central Italy (54% northern; 31% central). This data was largely expected since the northern and central Italian regions were the most affected by COVID-19 pandemic.

In two interesting, although worrying for the dental professionals, cases the dentists have been sued by one member of dental staff, who alleged an employer's responsibility raising from a lack of proper safety and preventive procedures in the dental office which caused a SARS-CoV 2 professional contagion.

The low reported rate of assignments for body identification emerged more as the consequence of the large underuse of dental data as primary identifier of unknown corpses in Italy, than as a noticeable impact of the pandemic.

The participants to the survey considered the recommendations for the clinical practice useful also in the forensic and medico-legal activity; video calls and video consultations were largely adopted.

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## CRediT authorship contribution statement

**Ilenia Bianchi:** Methodology, Investigation, Data curation, Writing – original draft. **Francesco Pradella:** Methodology, Data curation, Writing – original draft. **Giulia Vitale:** Data curation, Writing – original draft. **Stefano De Luca:** Data curation, Writing – original draft. **Forella Pia Castello:** Investigation, Data curation. **Martina Focardi:** Data curation, Writing – original draft. **Vilma Pinchi:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.forsciint.2023.111638.

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